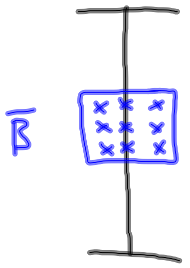
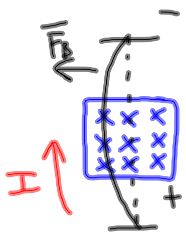
- Magnetic Force on a Current-carrying Wire:

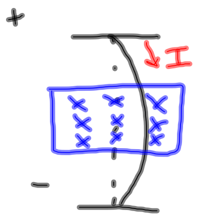


$I = 0\,A$

No current, so no moving charges, so no $\bar{F}_B$



Wire bends left, due to $\bar{B}$ and direction of current



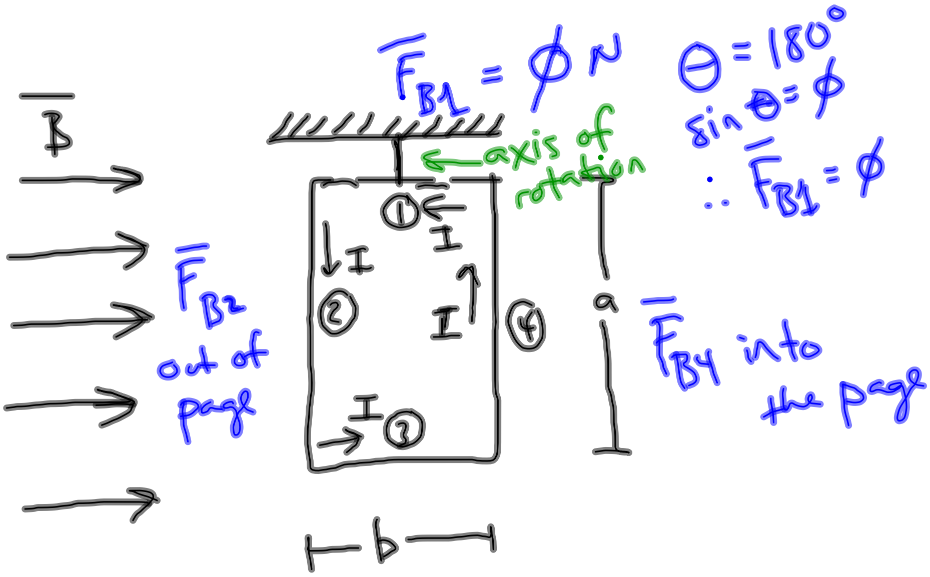
Wire bends right, again due to direction of current and $\bar{B}$

$$\bar{F}_B = I\,(\bar{L} \times \bar{B})$$

where $\bar{L}$ is the vector that points in the direction of I and has a magnitude equal to the length of the segment

$$F_B = ILB\sin\theta$$

θ = angle bet. $\bar{L}$ and $\bar{B}$



$\bar{F}_{B1} = 0\text{ N}$

$\theta = 180°$

$\sin\theta = 0$

$\therefore \bar{F}_{B1} = 0$

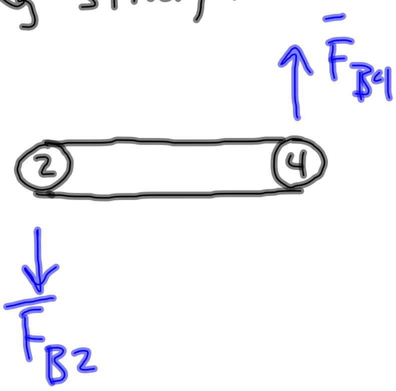
$\theta = 0°$

$\sin\theta = 0$

$\therefore \bar{F}_{B3} = 0\text{ N}$

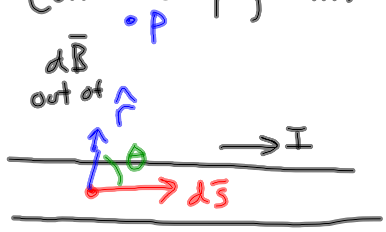
* this piece will spin ccw.

looking straight down:



Sources of Magnetic Fields:

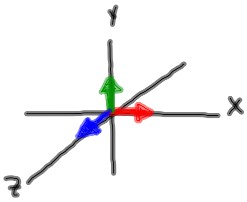
- Biot and Savart performed quantitative experiments on current-carrying wires.



- Biot-Savart Law:

$$d\bar{B} = \frac{\mu_0}{4\pi} \frac{I(d\bar{s} \times \hat{r})}{r^2}$$

μ_0 = permeability of free space
= 4π E -7 T·m/A



unit vector for x-direction is $\hat{i}$
example: $4\hat{i}$

unit vector in y-direction is $\hat{j}$
example: $2\hat{j}$

unit vector in z-direction is $\hat{k}$
example: $-10\hat{k}$

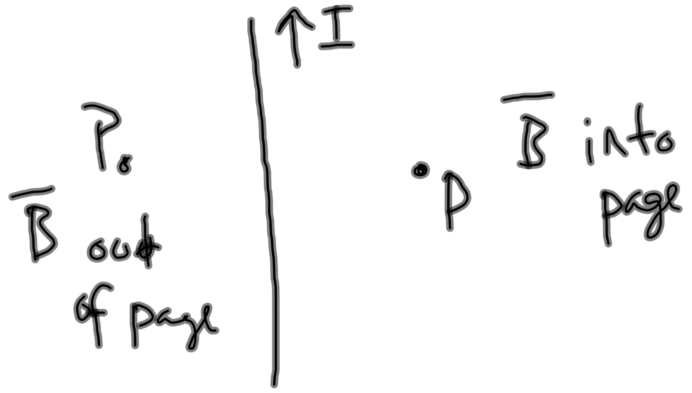
$$\bar{A} = 4\hat{i} + 2\hat{j} - 10\hat{k}$$

$$= \langle 4, 2, -10 \rangle$$

- Magnitude of $\overline{B}$ at a point some distance from a wire:

$$B = \frac{\mu_0 I}{2\pi r}$$

- Another Right-Hand Rule:



HW:

p. 832: 27, 29

p. 858: 1, 3, 5